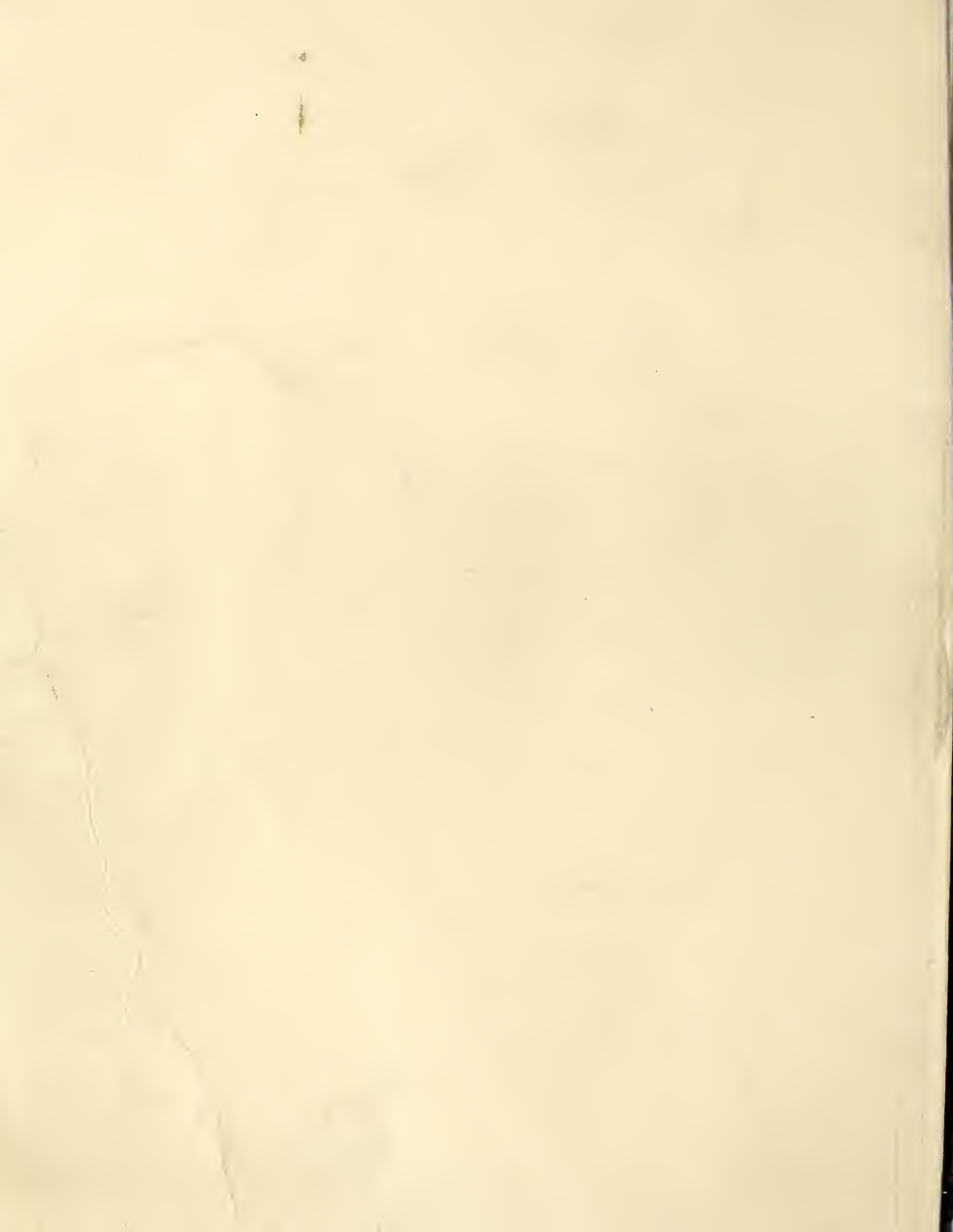


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Insects Emerging from Lodgepole Pine Infected by Comandra Blister Rust

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Insects were trapped from caged stem sections taken from 35 lodgepole pine trees girdled at mid to bottom crown by Comandra blister rust cankers (*Cronartium comandrae*). The trees were cut in 1987 and 1988 in two national forests in Wyoming and one in Montana. Two or three stem sections were removed from above, and one section from below, individual rust cankers. Emerging insects were collected biweekly for 5-8 months. *Pityogenes knechteli* was the most abundant bark beetle associated with cankered lodgepole pine, with *Pityophthorus murrayanae* and *Ips* sp. slightly less common. *Cylindrocopturus deleoni* was found occasionally. Insects nondamaging to lodgepole pine also emerged, including individuals in the families Anthicoridae, Cleridae, and Chrysomelidae. The mountain pine beetle (*Dendroctonus ponderosae*) was endemic in the collection areas but was not found on sampled trees.

Keywords: *Cronartium comandrae*, lodgepole pine, *Pityogenes knechteli*, *Pityophthorus murrayanae*

Introduction

Comandra blister rust (*Cronartium comandrae* Pk.) of lodgepole pine (*Pinus contorta* Dougl. ex Loud. subsp. *latifolia* (Engelm. ex Wats.) Critch.) causes stem cankers which eventually girdle and kill the tree.² On young trees girdling is low on the stem and causes mortality. On older trees cankers occur in the upper crown and often cause dead tops but not dead trees.² These cankers kill the cambium after aeciospore production because the blistering disrupts phloem and allows moisture loss (Krebill 1968). Rust cankers apparently do not immediately restrict water flow, because the stem above the canker may remain alive with green needles for up to two years.² The author has observed more rapid crown death above rust cankers when that section was attacked by Scolytid beetles (Coleoptera: Scolytidae).

Information on insects related to Comandra blister rust cankers is limited to insects associated with cankers, the alternate host, and the potential attraction of mountain pine beetles (*Dendroctonus ponderosae* Hopkins) to rust infected trees. Rasmussen (1987) suggested a possible positive relationship between comandra blister rust on lodgepole pine and subsequent mountain pine beetle attack. In Alberta, Powell (Powell 1971, 1972; Powell et al. 1972; Powell and Staley 1975) determined insects associated with Comandra blister rust on the alternate host and on rust cankers, but not with the death of the stem above cankers. Thus, the objective of this study was to identify insects that attack lodgepole pine trees and induce death of the stem above girdling Comandra blister rust cankers.

Materials and Methods

Lodgepole pine trees recently girdled by Comandra blister rust were selected along roads and near perma-

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² Geils, B.W.; Jacobi, W.R. Effects of Comandra blister rust on growth and survival of lodgepole pine. *Phytopathology*. [Accepted 10/12/92]

ment rust monitoring plots on the Laramie District, Medicine Bow National Forest, in southeast Wyoming; Wind River District, Shoshone National Forest, in northwest Wyoming; and on the Dillon and Wise River Districts, Beaverhead National Forest, in western Montana. Trees were felled and the length of the stem above the canker was measured. Two or three sections, 50 cm long, were removed from this stem portion at equal spacings above the cankers. One section was removed below the canker at approximately the same distance below the canker as the first sample was removed from above the canker. The first sample was 1-3 m above the canker. Samples were collected June through August, 1987, from 12 trees on the Shoshone and 6 trees on the Beaverhead National Forest. In July, 1988, 5 trees were cut on the Medicine Bow, 5 on the Shoshone, and 7 on the Beaverhead National Forests. Each tree selected had needle color ranging from yellow/green to red above the girdle. Exactly how long the trees had been girdled by the rust is not known but, previous work by Geils and Jacobi (1990) would suggest 0-2 years. Stems were examined from ground line to tree top for evidence of beetles by removing patches of bark with an axe.

Tree diameters at 1.3 m and tree heights averaged 15.7 ± 7.7 (std dev) cm and 11.3 ± 4.2 m respectively on trees cut in 1987 and 16.7 ± 5.8 cm and 11.1 ± 3.9 m in 1988. Canker heights averaged 4.2 ± 3.2 m in 1987 and 4.4 ± 2.8 m in 1988.

The stem sections were placed in screened funnel cages in a greenhouse and emerging insects were collected every 2 weeks for 5-8 months. In 1987, 8 out of 18 trees contained viable insects; in 1988, 15 out of 17 trees contained insects. All insects were identified at least to family, and to species if possible, and the number of individuals was recorded. All data summaries and Pearson's correlations were completed using programs of the SPSSX statistical package (SPSS 1986).

Results and Discussion

The most prevalent insects emerging from caged stem sections were, in descending order, *Pityogenes knechteli* Swaine, *Pityophthorus murrayanae* Blackman, *Ips* spp., and *Cylindrocopturus deleoni* Buchanan (table 1). *Pityogenes* beetles commonly infest pines, where they breed primarily in cut slash, fallen limbs, and occasionally in boles of small-diameter standing trees (Wood 1982). *P. murrayanae* beetles are commonly found in stems of trees < 20 cm in diameter, and occasionally in branches 1-4 cm in diameter (Wood 1982). *Ips* sp. also commonly breed in freshly cut slash, windfalls, and otherwise damaged trees (Furniss and Carolin 1977). *C. deleoni* attacks roots and root crowns of small lodgepole pine, and has been found on rust galls and cankers (Furniss and Carolin 1977). Powell (1971) found these same four insects on Comandra blister rust cankers in Alberta, Canada. Kulhavy et al. (1984) found *Pityogenes fossifrons* LeConte common in western white pine stressed by white pine blister rust cankers.

Table 1.—Insects from caged stem sections cut from above and below Comandra blister rust cankers.^a

Year	Trees with insects	Total Insects	Percent of Total ^b				
			Pityog	Pityop	Ips	Cylind	Other
1987	8/18	2,113	54.1	25.6	15.3	0.7	3.2
1988	15/17	6,500	78.5	15.7	2.5	0.3	2.9

^aLodgepole trees collected on three National Forests in WY and MT.

^bInsects collected from caged stem sections - Pityog = *Pityogenes knechteli*, Pityop = *Pityophthorus murrayanae*, Ips = *Ips* sp., Cylind = *Cylindrocopturus deleoni*, Other includes nondamaging insects in the following families; Anthocoridae, Cleridae, and Chrysomelidae.

Table 2.—Numbers of *Pityogenes knechteli*, *Pityophthorus murrayanae*, and *Ips* sp. emerging per cm² of bark from lodgepole pine girdled by Comandra blister rust cankers.

	Beetles per cm ² of stem surface ^a			
	Below Canker		Above Canker	
	1987	1988	1987	1988
Pityog	47	242	1	714
Pityop	4	2	8	153
Ips	21	58	27	12

^aValues are beetles per cm² of stem surface area ($\times 10^4$) for Ips = *Ips* spp., Pityog = *Pityogenes knechteli*, and Pityop = *Pityophthorus murrayanae*.

Thus, the insects responsible for the rapid death of lodgepole pine above Comandra blister rust cankers appear to be *Pityogenes knechteli*, *Pityophthorus murrayanae*, *Ips* spp., and possibly *Cylindrocopturus deleoni*.

These insects did not seem to attack trees of any particular size or rust canker situation. Insect numbers did not consistently correlate with dbh, section diameter, canker height, or section height. Most insects were collected from trees with various degrees of yellow or red needles above the rust canker. Few to no insects emerged from trees with green/yellow or brown/red needles (the year following beetle attack, foliage begins to turn yellow to red and then brown).

The three most abundant bark beetles were more attracted to the stem above the girdling canker than below it except for *Pityogenes knechteli* in 1987 and *Ips* spp. in 1988 (table 2). *Pityogenes knechteli* was the most common beetle found in stem sections from below cankers (table 2). All sections collected below the canker had the three beetle species found above the canker. Thus, the stressed tree top and associated beetle attack may cause lower sections of the stem to be attacked by bark beetles.

No mountain pine beetles emerged from stem samples, nor was any evidence of this insect, such as pitch tubes or internal galleries, observed. Amman and Safranyik (1985) suggested *Pityogenes* and *Pityophthorus* beetles infest stressed trees, and mountain pine beetles subsequently infest the lower meter of the stem. Because the sample size was small and mountain pine

beetle infested trees were not evident within 30 m of the sampled trees, such a relationship can not be discounted. Thus, the role rust cankered trees play as hosts to various scolytid bark beetles, and endemic mountain pine beetles in particular, needs further elucidation. Nevertheless, the identity of the bark beetles responsible for rapid top kill of rust-girdled trees is now known for several areas in the central Rocky Mountains.

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